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State of California
The Resources Agency
DEPARTMENT OF FISH AND GAME

STANDING STOCKS OF FISHES IN SECTIONS
OF INDIAN CREEK, PLUMAS COUNTY, 1980

by

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Bay-Delta Fishery Project
Contract Services Section
Information Report
81-1

This report, which has been reviewed only by the Contract Services Supervisor, contains data that would not otherwise be available in a report format. The work was funded by the Department of Water Resources under W.A. 1600.

INTRODUCTION

In 1976, the Department of Water Resources (DWR) initiated an instream flow program to identify streams that would benefit from flow enhancement, to assess instream values and to identify trade-offs required to enhance these streams. The Northern District of DWR selected Indian Creek below Antelope Reservoir (Figure 1) as one of the streams to study under this program. Initial flow studies by DWR indicated that flow augmentation could double trout habitat in the first 16 km of Indian Creek below the dam and increase habitat by 25% in lower reaches (Hinton, MS). As a result of this study, DWR with the support of the Department of Fish and Game (DFG) decided to reoperate Antelope Reservoir to increase flow releases from 0.1 cms to 0.6 cms year-round on a trial basis. These flows would not impair recreation at Antelope Reservoir.

The role of the Contract Services Section in this study is to monitor fish populations in selected sections of Indian Creek and assist DWR personnel in determining fishing effort and catch in the creek. This report describes sections of the creek sampled, fish species caught, and fish biomass at each station.

METHODS

Standing stocks of fishes were estimated at six stations (each containing riffles and pools) in Indian Creek (Figure 1). Stations were intentionally selected to be near stations sampled in previous DFG regional studies. Markers were placed in trees along the stream to permanently identify station boundaries for future sampling. Each station was not necessarily representative of the stream reach in which it was located. Stations varied

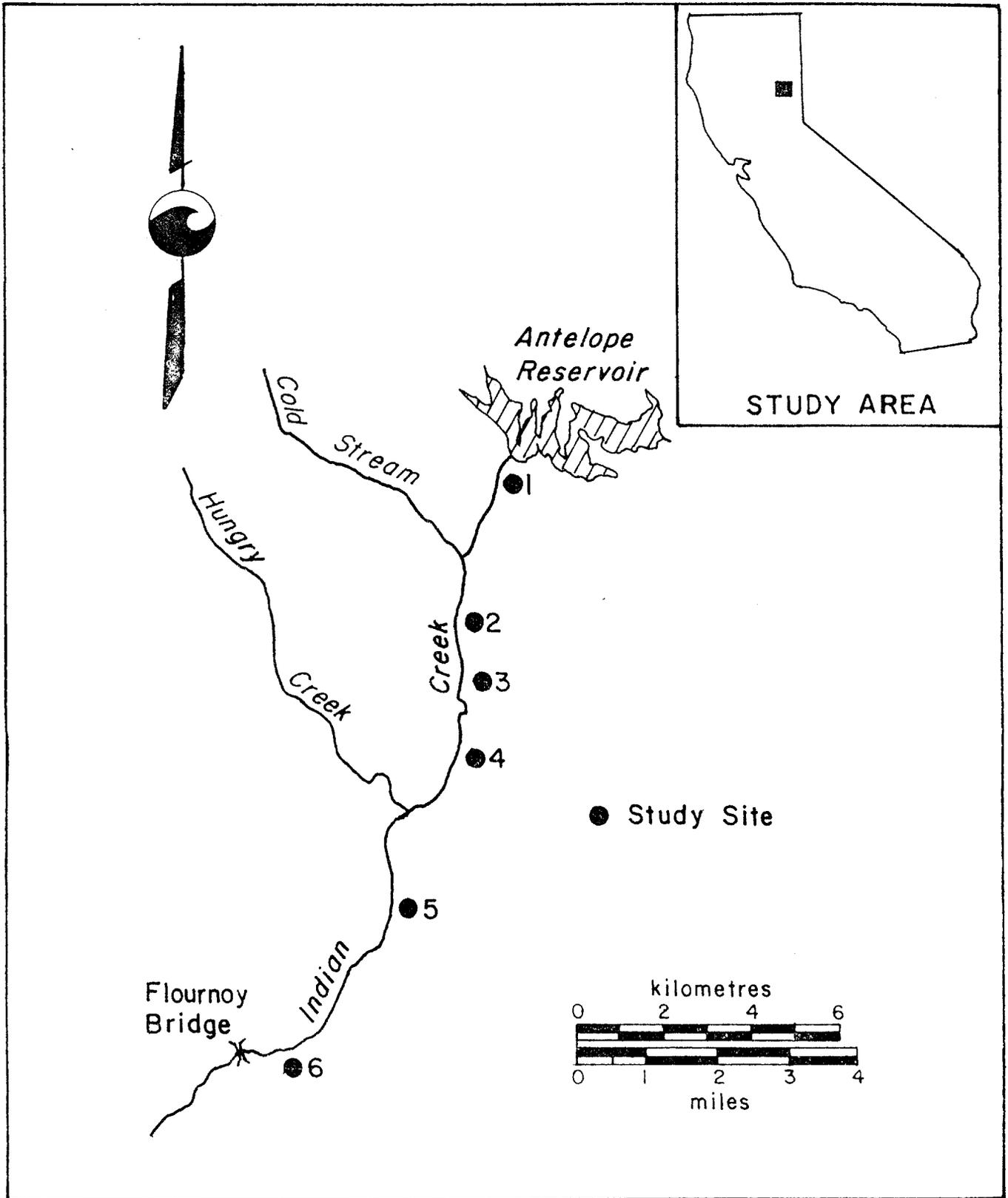


Figure 1 - Stations sampled to determine biomass of fishes in Indian Creek, Plumas County, September 1980

in length from 34 to 72 m, and the length, average width, and average depth of each station were measured. Fish were captured with battery-powered backpack or portable generator-powered electroshockers in stream sections which were blocked with nets. Fish were removed from the section on each pass. Standing stock estimates were developed using the two-count method of Seber and LeCren (1967).

The weight of each fish was determined to the nearest gram by water displacement in a graduated cylinder. Fork length of each fish was measured to the nearest millimetre.

Fish scales were mounted dry between microscope slides and the scale images were projected through a Bausch and Lomb microprojector at a magnification of 42X. Scale annuli and radii were measured to the nearest millimetre along the anterior radius of the anterior-posterior axis of the scale.

Predictive regressions were used to describe the body-scale and length-weight relationships (Ricker, 1975). Estimation of true mean growth rate (G) was calculated using the methods of Ricker (op. cit.).

RESULTS

Distribution

We caught brown trout (Salmo trutta), rainbow trout (Salmo gairdneri), golden shiner (Notemigonus crysoleucas), Sacramento squawfish (Ptychocheilus grandis), Lahontan redband (Richardsonius egregius), Sacramento sucker (Catostomus occidentalis), and brown bullhead (Ictalurus nebulosus). Brown trout were caught at every station. We observed rainbow trout and golden shiner throughout the creek, although we did not catch them at each station.

Sacramento squawfish and Sacramento suckers were caught at the lowest section. One Lahontan redbside was caught in Station 1 (Table 1).

Standing Crop

Brown trout was the most common game fish caught and biomass averaged 6.0 g/m^2 at six stations (Table 2). Rainbow trout averaged 4.4 g/m^2 in four stations (Table 3). Brown trout large enough to be kept by most fishermen (127 mm FL) averaged 5.5 g/m^2 in six stations and rainbow trout large enough to be kept averaged 1.7 g/m^2 in four stations.

Brown bullhead was the most common non-salmonid fish caught. We calculated an average biomass of 9.1 g/m^2 for four stations. Golden shiner biomass averaged 1.0 g/m^2 for two stations. Sacramento squawfish and Sacramento sucker biomass in the lowest station was 0.3 g/m^2 and 1.8 g/m^2 , respectively. Lahontan redbside biomass in Station 1 was 0.008 g/m^2 (Table 4).

Age and Growth

The formula $L = 27.9 + 1.015 S$ describes the relationship between the fork length (L) and enlarged scale radius (S) of 203 brown trout. The coefficient of correlation (r) is 0.93. The formula was $L = 46.5 + 0.970 S$ for 71 rainbow trout. The value for r is also 0.93.

Growth as measured for the population and for the mean of individual growth rates was faster for age 1+ brown trout than for the age 2+ fish (Table 5). We did not compute growth for rainbow trout.

We caught no brown trout older than 3+ years. Fish of this age averaged 291 mm in length, while 2+ fish averaged 197 mm, and 1+ fish averaged 106 mm (Table 6).

TABLE 1
 DISTRIBUTION OF FISHES IN SECTIONS OF
 INDIAN CREEK, PLUMAS COUNTY, 1980

	Station Number					
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>
Distance below Antelope Dam (km)	0.6	3.9	5.3	6.8	12.3	21.0
Brown Trout	X	X	X	X	X	X
Rainbow Trout	X	X	X	X	X	X
Brown Bullhead	X		X	X	X	
Lahontan Redside	X					
Golden Shiner	X				X	
Sacramento Sucker						X
Sacramento Squawfish						X

TABLE 2

ESTIMATES OF BROWN TROUT STANDING CROP IN
INDIAN CREEK, PLUMAS COUNTY, 1980

Distance Below Antelope Dam (km)	Population Estimate	95 Percent Confidence Interval	Biomass g/m ²	Estimate of Catchable Trout (≥ 127 mm FL)	Biomass of Catchable Trout g/m ²
0.6	61	54-68	8.6	56	8.5
3.9	94	87-100	9.6	71	8.3
5.3	90	87-94	11.2	69	9.9
6.8	40	39-41	3.8	26	3.5
12.3	31	30-33	3.0	23	1.6
21.0	6	6-6	1.2	5	1.1

TABLE 3

ESTIMATES OF RAINBOW TROUT STANDING CROP IN
INDIAN CREEK, PLUMAS COUNTY, 1980

Distance Below Antelope Dam (km)	Population Estimate	95 Percent Confidence Interval	Biomass g/m ²	Estimate of Catchable Trout (≥ 127 mm FL)	Biomass of Catchable Trout g/m ²
0.6	87	79-94	3.7	32	2.2
3.9	5	5-5	0.7	4	0.7
5.3	0	0	0	0	0
6.8	0	0	0	0	0
12.3	25	22-28	0.5	4	0.4
21.0	22	22-22	12.5	10	3.4

TABLE 4

ESTIMATES OF STANDING CROPS OF NONGAME FISHES
IN INDIAN CREEK, PLUMAS COUNTY, 1980

<u>Distance Below Antelope Dam (km)</u>	<u>Species</u>	<u>Population Estimate</u>	<u>95 Percent Confidence Interval</u>	<u>Biomass g/m²</u>
0.6	Brown Bullhead	4	1-10	0.4
0.6	Lahontan Redside	1	1-1	0.008
0.6	Golden Shiner	38	35-41	1.5
3.9	--	-	--	-
5.3	Brown Bullhead	22	22-23	6.2
6.8	Brown Bullhead	1	1-1	0.1
12.3	Brown Bullhead	205	203-207	29.5
12.3	Golden Shiner	5	5-5	0.4
21.0	Sacramento Squawfish	9	9-9	0.3
21.0	Sacramento Sucker	5	3-7	1.8

TABLE 5

GROWTH RATES FOR BROWN TROUT
CAUGHT IN INDIAN CREEK, 1980

Age Interval	Population Growth			Mean Individual Growth		
	Length Interval mm	Difference of Natural Logarithms	Instantaneous Growth Rate Gx	Length Interval mm	Difference of Natural Logarithms	Instantaneous Growth Rate G
1-2	97-194	0.683	2.056	122-194	0.464	1.466
2-3	194-291	0.405	1.219	211-291	0.321	0.921

TABLE 6

CALCULATED FORK LENGTH IN MILLIMETRES
OF BROWN TROUT FROM INDIAN CREEK,
PLUMAS COUNTY, TAKEN IN SEPTEMBER 1980

Age	Number of Fish	Length at Capture (mm)	Calculated Lengths at Successive Annuli (mm)		
			1	2	3
1	134	160	97	-	-
2	54	224	122	194	-
3	11	327	128	211	291
Number of back-calculations			199	65	11
Weighted means			105	197	291
Increments			105	92	94

TABLE 7

CONDITION OF BROWN TROUT AND RAINBOW TROUT
IN INDIAN CREEK, 1980

<u>Age Group</u>	<u>Number of Fish</u>	<u>Coefficient of Condition</u>	<u>95% Confidence Interval</u>
Brown Trout			
0+	78	1.0544	±0.0322
1+	218	1.0532	±0.0170
2+	15	1.0357	±0.0476
3+	2	1.1198	±0.0470
Combined	313	1.0531	±0.0145
Rainbow Trout			
0+	20	1.0866	±0.0680
1+	38	1.0510	±0.0500
2+	11	1.0931	±0.0841
3+	2	1.4441	±0.3310
Combined	71	1.0786	±0.0391

Length and Weight

Age group 0+ brown trout represented 25% of the catch, while 1+ fish made up 69%, 2+ fish comprised 5% and 3+ fish represented 1% (Figure 2). In contrast, age 0+ rainbow trout comprised 64% of the catch while age 1+ comprised 25%, age 2+ comprised 9%, and age 3+ comprised 2% (Figure 3).

The relationship between length (L) and weight (W) of brown trout is:

$$\text{Log}_{10}W = -5.001 + 3013 \text{Log}_{10}L$$

$$r = 0.99$$

$$N = 203 \text{ (Figure 4)}$$

The same relationship for rainbow trout is:

$$\text{Log}_{10}W = -5.118 + 3.067 \text{Log}_{10}L$$

$$r = 0.99$$

$$N = 71 \text{ (Figure 5)}$$

Coefficient of Condition

We calculated the coefficient of condition and 95% confidence limits for 313 brown trout and 71 rainbow trout (Table 7).

There is no significant difference between the coefficient of condition for any age group of brown trout we tested ("t" test, 0.05 level). The coefficient of condition for age 3+ rainbow trout was significantly greater ("t" test, 0.05 level) than all other age groups. However, there are no significant differences between age 0+, 1+ and 2+ rainbow trout.

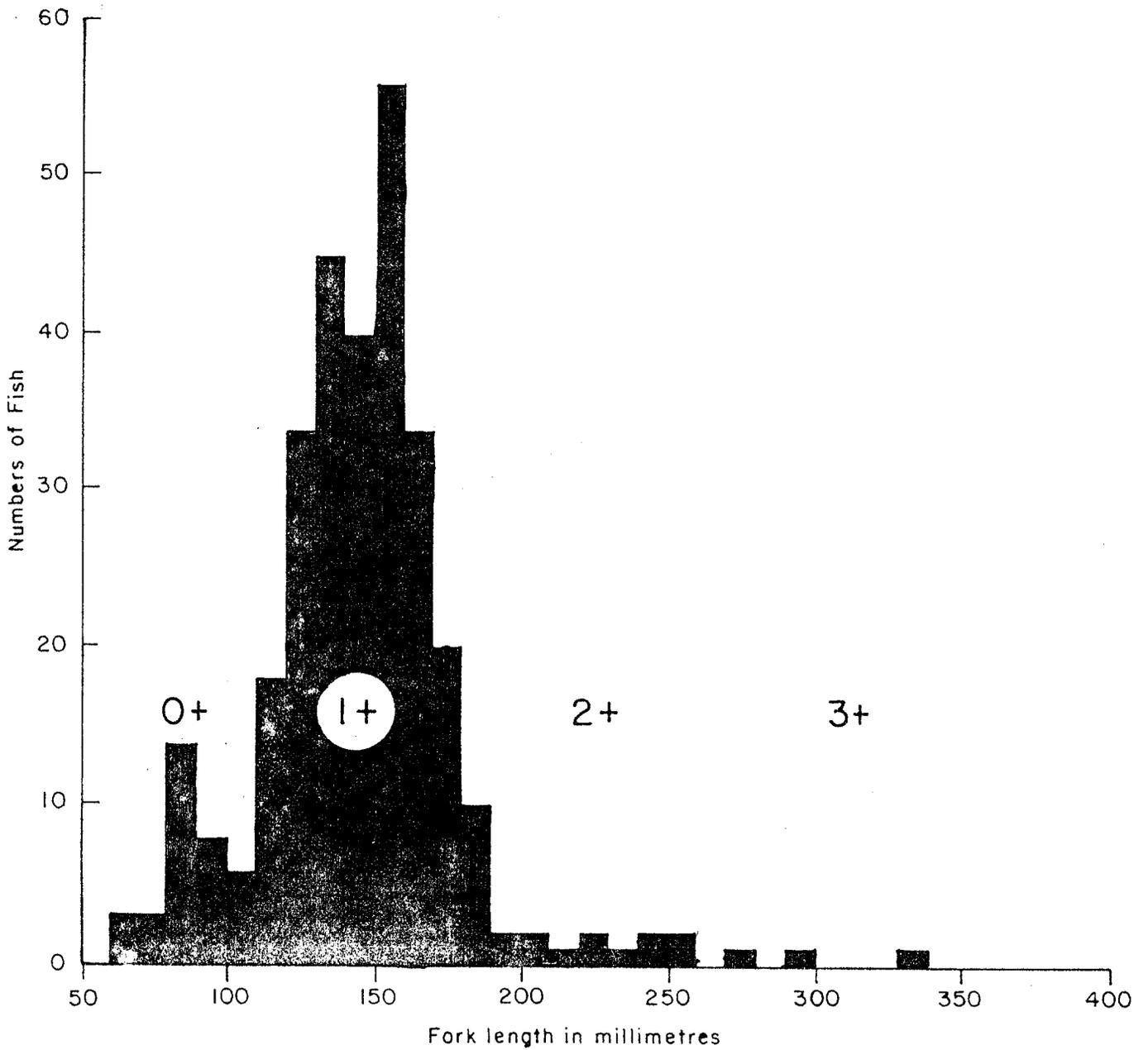


Figure 2 - Length, frequency of occurrence, and age of brown trout caught in sections of Indian Creek, Plumas County, 1980.

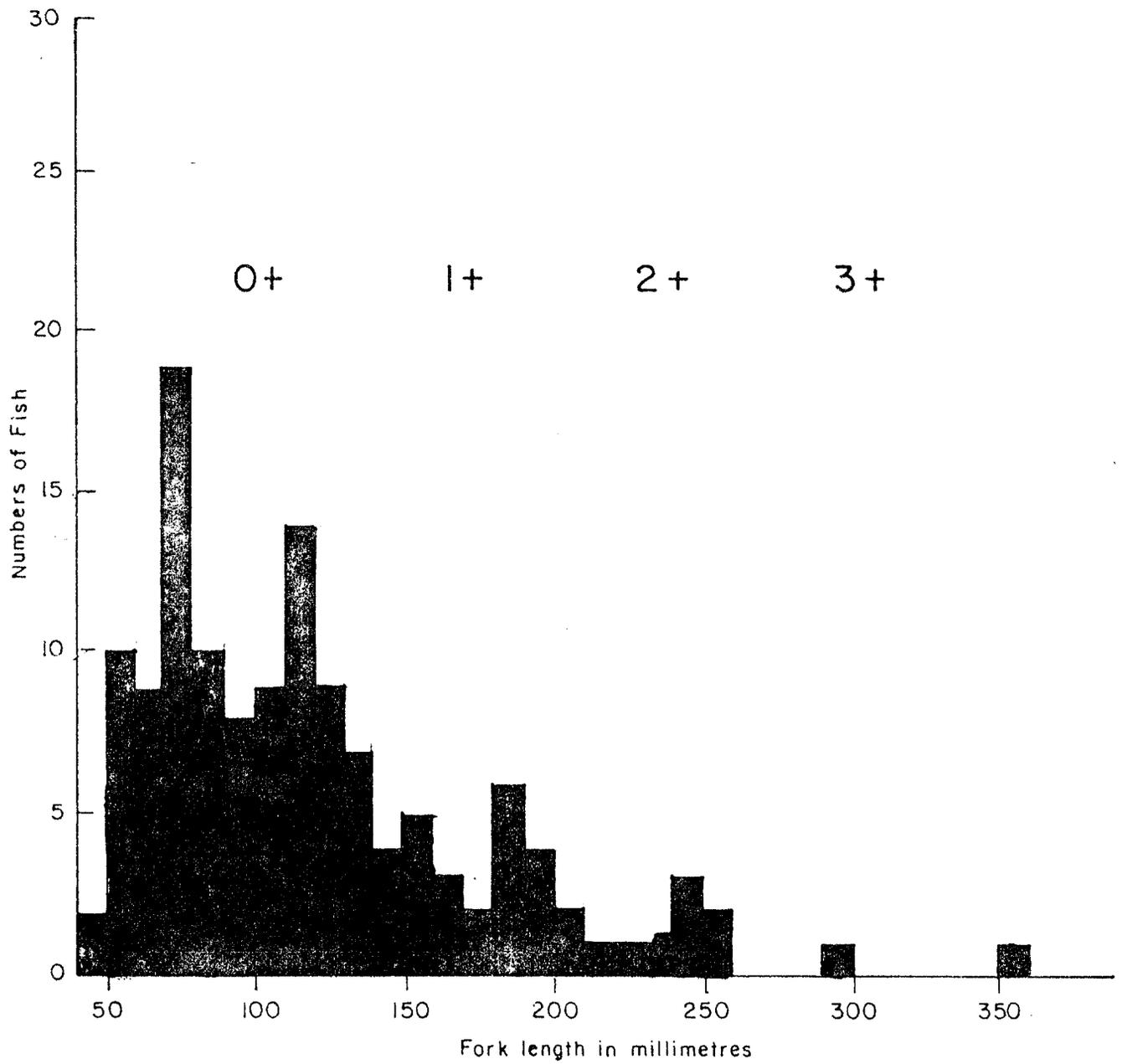


Figure 3 - Length, frequency of occurrence, and age of rainbow trout in sections of Indian Creek, Plumas County, 1980.

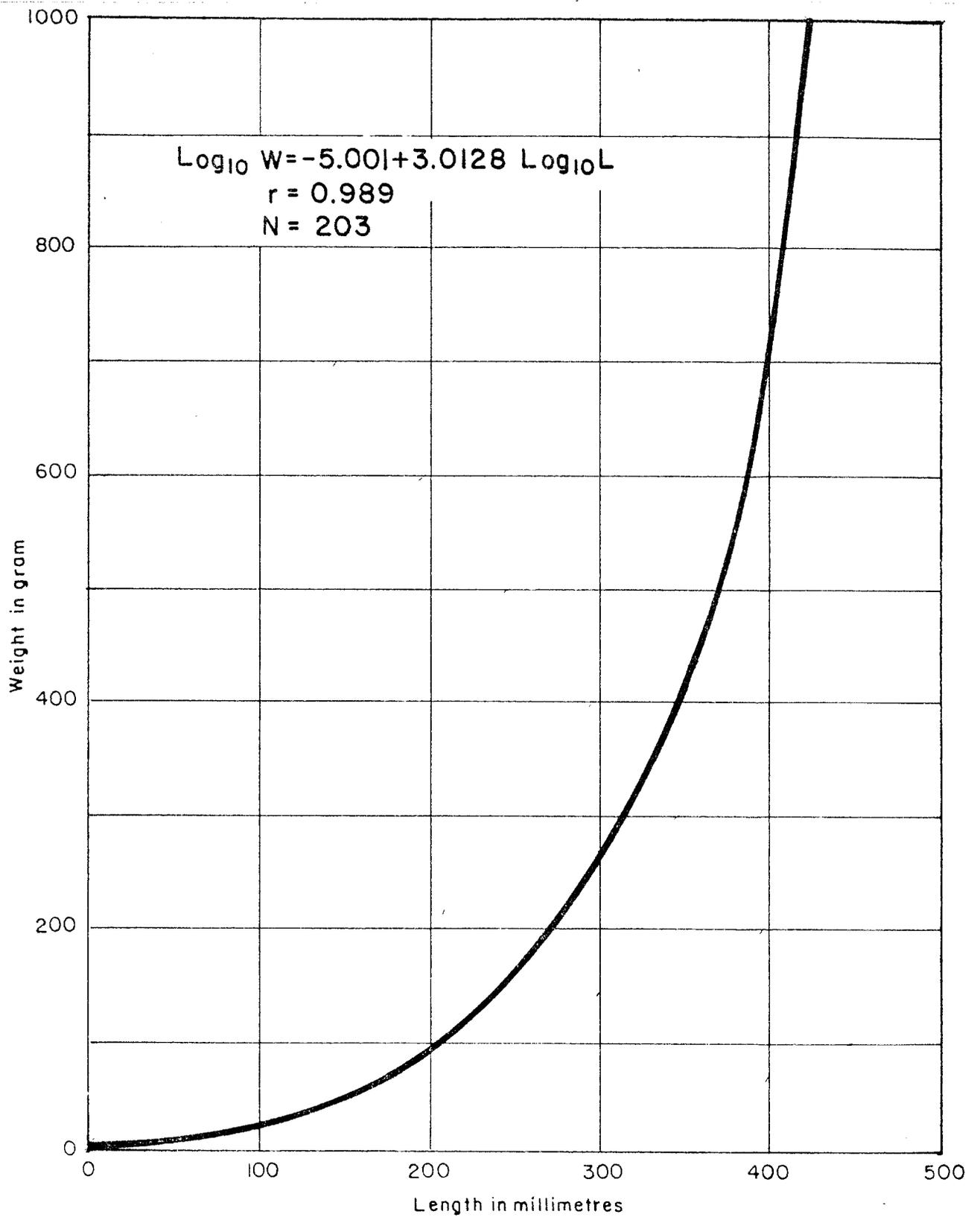


Figure 4 - The relationship between length and weight of brown trout caught in sections of Indian Creek, Plumas County, 1980.

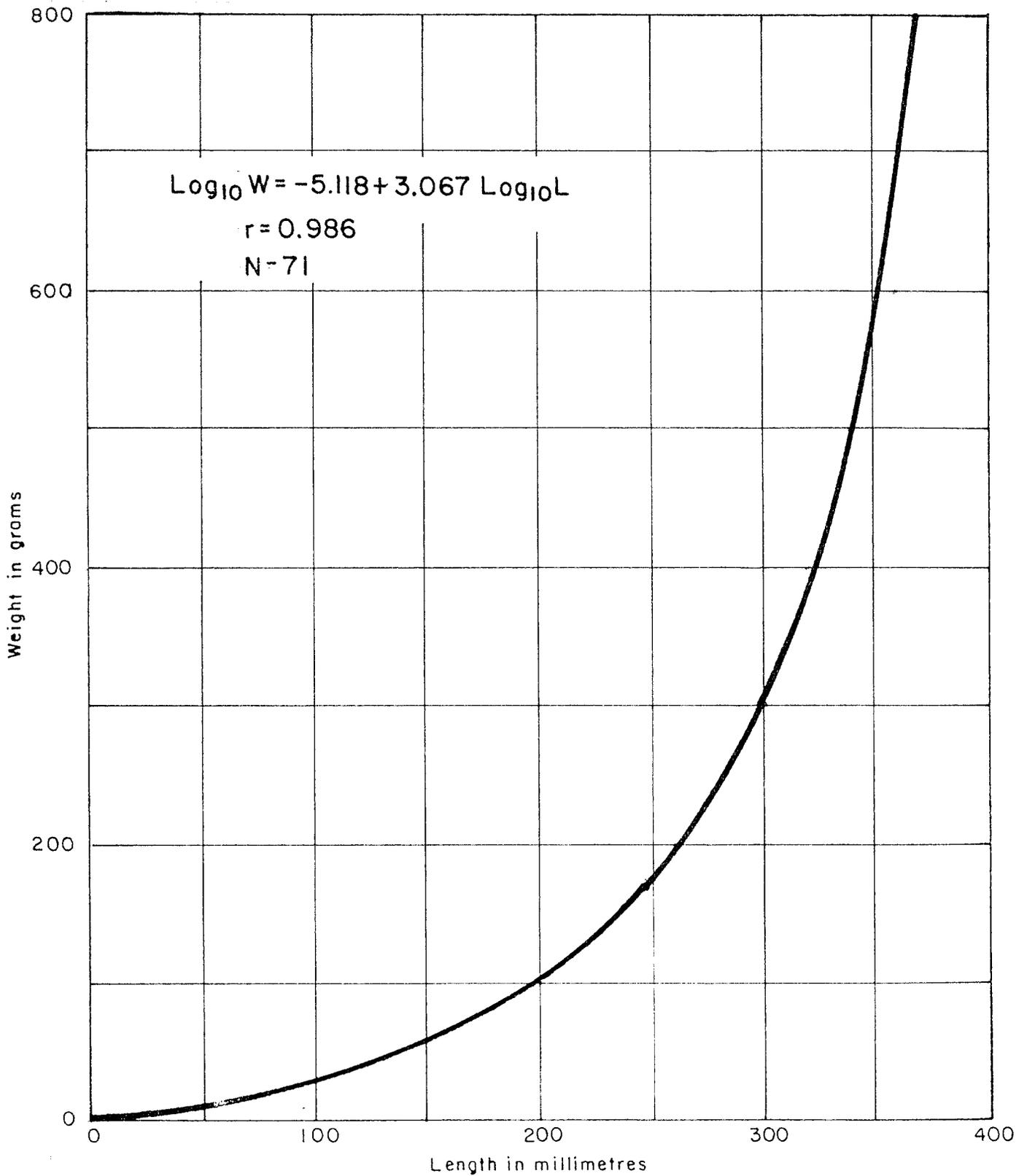


Figure 5 – The relationship between length and weight of rainbow trout caught in sections of Indian Creek, Plumas County, 1980

LITERATURE CITED

- Ricker, W. E. 1975. Computation and interpretation of biological statistics of fish populations. Fisheries Research Board of Canada, Bulletin 191, 382 pp.
- Seber, G. A. F., and E. D. LeCren. 1967. Estimating population parameters from catches large relative to the population. J. Animal Ecology. 36(3): 631-643.

APPENDIX 1
PERMANENT FISH POPULATION STATIONS
INDIAN CREEK, PLUMAS COUNTY
SEPTEMBER 1980

APPENDIX I

PERMANENT FISH POPULATION STATIONS INDIAN CREEK, PLUMAS COUNTY SEPTEMBER 1980

Station 1 - Located 0.6 km below Antelope Dam adjacent to picnic area near junction of Indian Creek Road and spur road leading to base of dam (NE $\frac{1}{4}$ of NE $\frac{1}{4}$, Section 27, T27N, R12E). The station extends 48 m upstream and 24 m down stream from a 13-cm-diameter pine (LB). The station consists of a riffle (40%) and a long pool (60%). This station has been modified from previous years by a beaver dam constructed downstream which has turned the wrong portion of the station (formerly riffle) into a deep pool. The station has a surface area of 764 m² and a volume of 291 m³ at 0.6 cms.

Station 2 - Located 13.8 km above Flourney Bridge, 1.9 km below Cold Stream, and about 3.9 km below Antelope Dam (SW $\frac{1}{2}$ of SW $\frac{1}{2}$, Section 34, T27N, R12E). The station extends 35 m from a 36-cm-diameter alder (RB) downstream to a 10-cm-diameter pine (RB). Both are marked with metal disks which can be seen from the road. The station contains riffle (65%) and shallow pool (35%) areas. It has a surface area of 310 m² and a volume of 101 m³ at 0.6 cms.

Station 3 - Located 11.5 km above Flourney Bridge, 3.7 km above Hungry Creek, and about 5.3 km below Antelope Dam (NW $\frac{1}{4}$ of NW $\frac{1}{4}$, Section 10, T26N, R12E). The lower end of the station is about 29 m upstream from the upper end of a parking turnout. The station extends 40 m upstream from a 38-cm-diameter alder (RB) to a 28-cm diameter pine (RB). Both are marked with metal disks which can be seen from the creek. The section contains a riffle area which enters a 0.9 m-deep pool followed by a riffle and a shallow pool₂ (Riffle area totals 40%₃, pool area 60%). It has a surface area of 284 m² and a volume of 106 m³ at 0.6 cms.

Station 4 - Located 10.9 km above Flourney Bridge and about 6.8 km below Antelope Dam (NW $\frac{1}{2}$ of SW $\frac{1}{4}$, Section 10, T26N, R12E). Upper end of station is just downstream from a drainage ditch at the lower end of a parking turnout located 0.3 km above Babcock crossing. Station extends 40 m downstream to the end of a riffle just above a long, shallow pool. It contains riffle (55%) and shallow pool (45%) areas with a small amount of undercut bank (RB)₂. It is not marked with₃ metal disks. The station has a surface area of 328 m² and a volume of 65 m³ at 0.6 cms.

Station 5 - Located at unimproved campground about 5.5 km upstream from Flourney Bridge and about 12.3 km below Antelope Dam (SW $\frac{1}{4}$ of SW $\frac{1}{4}$, Section 21, T26N, R12E). The station extends 70 m upstream from the lower end of a riffle area with several grassy hummocks (Transect 3 of the fish habitat evaluation study). Metal disks on a small willow at the lower end (LB) and a large alder snag at the upper end (RB) mark the station. The station contains a riffle and shallow run area, a shallow pool with undercut bank (RB), and a riffle₂ area. (Riffle area is 60%, pool area 40%). It has a surface area of 685 m² and a volume of 169 m³ at 0.6 cms.

Station 6 - Located about 0.9 km upstream from Flournoy Bridge and about 21 km below Antelope Dam. Drive 0.3 km east of Flournoy Bridge and take paved spur road to right. Drive 0.6 km to gate in fence on right side of road. Follow trail from gate downstream 85 m along creek where alders on RB end and a steep riffle enters a pool. The lower end of the station is at the top of the steep riffle. The station extends 40 m upstream and is marked with metal disks on 10-cm-diameter alders (RB). The disks are hard to find because there are lots of alders along the right bank. The upper half of the station is a riffle and shallow pool, followed by a rocky run and a small pool in the lower half. (Riffle area totals 45%, pool area 55%). The station has a surface area of 372 m² and a volume of 107 m³ at 0.6 cms.

APPENDIX 2
LENGTH AND WEIGHT OF BROWN TROUT
CAUGHT IN INDIAN CREEK, SEPTEMBER 1980

APPENDIX 2

LENGTH AND WEIGHT OF BROWN TROUT
CAUGHT IN INDIAN CREEK, SEPTEMBER 1980

Length (mm)	Weight (g)	Length (mm)	Weight (g)	Length (mm)	Weight (g)
57	2.5	128	20,20,21	165	43,48
66	3.25	129	22,23,23,23,24	166	45,50,55
69	3	130	22,22,24	167	53
72	3.5	131	22,22	168	42,48,50,59
75	4.25	132	21,22,23,24,46	169	48,52,55
77	5	133	14,22,24,24,26	170	48,49,50,52,52,54
80	4.25,5,5.5	134	22,22,24,26	171	50,54,56,60
81	5.5,8	135	22,23,24,26,26,26	172	55,60
82	5.5	136	23,23,25,25,25,26	173	48,51, 52
84	6,7,7.5	137	24,24,25,28	174	65
86	7,7,7	138	28,29,30,32	177	60,65
87	6.5	139	26,28,28,28,30,30	178	70,82
88	7	140	26,28,28,28,30	179	62
91	8.5	141	28,30	180	60,60,68
92	8,8,8.5	142	30,30,30,30,30,30,33	181	70
93	8,9	143	28,32	183	62,65
94	8,8	144	28,28,30,30,32	184	58
101	11	145	28,30,32,32,34	185	62,69
105	9	146	30,32,36,37,38,40,53	187	65
106	11	147	30,30	192	68
107	12	148	32,34,36,48	198	90
108	14	149	32,34,36,38	205	75
109	14	150	34,34,34,37,46,30,32	206	100
110	14		32,34,34,34,34,34	217	110
111	14,14	151	31,34,38	218	120
112	16,16	152	35,36,36,38,38,40,40,	223	110
114	14		42,46	228	125
115	15,15,15	153	37,38,39	231	130
116	14,14,14,16	154	34,36,36,37,38,38,40,42	233	135
117	16,18,18,18	155	34,36,36,38,42,42	240	135,148
119	20	156	36,38,40	250	150
120	17,18,20	157	38,38	258	150
121	16,17,18	158	36,37,42,42,43,44,44,48	278	240
122	18,18,18	159	40,40,50	298	290
123	19,22,32	160	42,42,44,46,58	335	430
124	18,20,24,26	161	38,42,42,43,46		
125	18,18,20	162	40,44,48		
126	20,20	163	40,41,46,50,50,50		
127	17,20,22,24,26	164	42		

APPENDIX 3

LENGTH AND WEIGHT OF RAINBOW TROUT
CAUGHT IN INDIAN CREEK, SEPTEMBER 1980

APPENDIX 3

LENGTH AND WEIGHT OF RAINBOW TROUT
CAUGHT IN INDIAN CREEK, 1980

Length (mm)	Weight (g)	Length (mm)	Weight (g)	Length (mm)	Weight (mm)
42	1	96	11	142	30
46	1	97	8.5	144	32
50	1.25,1.25	98	11	149	40
52	1	100	11	150	38,42
53	2.25	101	12	153	35
55	2,2.5	103	10,16	154	36
57	2,2	104	13	158	38
58	1.5,2.5	106	8,12	161	44
60	4	108	14	164	50
61	3	109	12	167	65
62	2	110	16,20	173	55
63	2.25	111	18	177	52
64	1.5	112	16	180	54,60,70
65	3	113	12,16	182	70
68	3,4.5	115	14	184	65
69	3	116	14	187	85
70	3.5,4,4.25	117	18,20	191	56
72	4,4,4.5	118	16,18,18,20	193	68
73	4.75	120	14,16,18	194	75
74	4,4,4,4.5,8	122	18	196	70
75	4,5.5	123	20	200	80
78	4.5	126	18	209	100
79	5,5,5	127	19	217	115
80	5,5.5,6	128	23	229	155
81	6,6	129	29	232	100
83	5.25	130	22	244	180
84	6,6	132	26	246	150
86	7	134	26	247	140
87	7	137	22	250	155
92	8	138	36	256	155
94	10	139	26,28	293	270
95	8,9,9	141	28	358	740

APPENDIX 4

METRIC CONVERSION FACTORS

APPENDIX 4

METRIC CONVERSION FACTORS

<u>Quantity</u>	<u>Metric Units</u>	<u>Divide by</u>	<u>English Units</u>
Length	millimetres (mm)	25.4	inches (in)
	centimetres (cm)	2.54	inches (in)
	metres (m)	0.3048	feet (ft)
	kilometres (km)	1.6093	miles (mi)
Area	square metres (m ²)	0.0029	square feet (ft ²)
Volume	cubic metres (m ³)	0.7646	cubic yards (yd ³)
Flow	cubic metres per second (cms)	0.0083	cubic feet per second (cfs)
Biomass	grams per square metre (g/m ²)	8.92	pounds per acre (lb/acre)